



GCE A LEVEL MARKING SCHEME

SUMMER 2023

**A LEVEL
GEOLOGY – COMPONENT 2
A480U20-1**

INTRODUCTION

This marking scheme was used by WJEC for the 2023 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

GCE A LEVEL GEOLOGY
COMPONENT 2 - GEOLOGICAL PRINCIPLES AND PROCESSES
SUMMER 2023 MARK SCHEME

Instructions for examiners of A Level Geology when applying the mark scheme

1 Positive marking

It should be remembered that candidates are writing under examination conditions and credit should be given for what the candidate writes, rather than adopting the approach of penalising him/her for any omissions. It should be possible for a very good response to achieve full marks and a very poor one to achieve zero marks. Worthwhile answers that meet the requirements of the question, but do not appear on the mark scheme are to be given credit.

2 Tick marking

Low tariff questions should be marked using a points-based system. Each credit worthy response should be ticked in red pen. The number of ticks must equal the mark awarded for the sub-question. The mark scheme should be applied precisely using the marking details box as a guide to the responses that are acceptable. Do not use crosses to indicate answers that are incorrect.

3 Annotated diagrams

Where a candidate has answered a question wholly or partly by use of an annotated diagram, credit must be awarded to the annotations which form credit-worthy responses as outlined in the marking details box. Candidates must be credited only once for valid responses which appear both as annotations to diagrams and within a section of prose in the answer to the same question.

4. Banded mark schemes

Banded mark schemes are divided so that each band has a relevant descriptor. The descriptor for the band provides a description of the performance level for that band. Each band contains marks. Examiners should first read and annotate a learner's answer to pick out the evidence that is being assessed in that question. **Do not use ticks** on the candidate's response. Once the annotation is complete, the mark scheme can be applied. This is done as a two-stage process.

Stage 1 – Deciding on the band

When deciding on a band, the answer should be viewed holistically. Beginning at the lowest band, examiners should look at the learner's answer and check whether it matches the descriptor for that band. Examiners should look at the descriptor for that band and see if it matches the qualities shown in the learner's answer. If the descriptor at the lowest band is satisfied, examiners should move up to the next band and repeat this process for each band until the descriptor matches the answer.

If an answer covers different aspects of different bands within the mark scheme, a 'best fit' approach should be adopted to decide on the band and then the learner's response should be used to decide on the mark within the band. For instance if a response is mainly in band 2 but with a limited amount of band 3 content, the answer would be placed in band 2, but the mark awarded would be close to the top of band 2 as a result of the band 3 content.

Examiners should not seek to mark candidates down as a result of small omissions in minor areas of an answer.

Stage 2 – Deciding on the mark

Once the band has been decided, examiners can then assign a mark. During standardising (marking conference), detailed advice from the Principal Examiner on the qualities of each mark band will be given. Examiners will then receive examples of answers in each mark band that have been awarded a mark by the Principal Examiner. Examiners should mark the examples and compare their marks with those of the Principal Examiner.

When marking, examiners can use these examples to decide whether a learner's response is of a superior, inferior or comparable standard to the example. Examiners are reminded of the need to revisit the answer as they apply the mark scheme in order to confirm that the band and the mark allocated is appropriate to the response provided.

Indicative content is also provided for banded mark schemes. Indicative content is not exhaustive, and any other valid points must be credited. In order to reach the highest bands of the mark scheme a learner need not cover all of the points mentioned in the indicative content but must meet the requirements of the highest mark band. Where a response is not creditworthy, that is contains nothing of any significance to the mark scheme, or where no response has been provided, no marks should be awarded.

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
1.	(a)		Fossil X = trilobite Fossil Y = bivalve	2			2		
	(b)	(i)	Any three x (1) from: <ul style="list-style-type: none"> • increase through the Cambrian • decrease in the Ordovician • drop at the end/start of the Ordovician • stasis through the Silurian • additional detail in Cambrian or Ordovician • exemplar value 	3			3	3	3
		(ii)	Start of Triassic = $240 - 80 = 160$ (1) End of Cretaceous = $700 - 150 = 550$ (1) Percentage change (greatest possible) (1) $= (590 - 140) / 140 \times 100 = 321\%$ or percentage change (smallest possible) $= (450 - 180) / 180 \times 100 = 150\%$		3		3	3	3
	(c)		No mark for recognising statement is incorrect. Example supporting the statement e.g., end Ordovician, end Devonian, end Permian, end Triassic, end Cretaceous (1) Example not supporting the statement e.g., end Cambrian, end Silurian, end Carboniferous, end Jurassic (1)			2	2		

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
	(d)	(i)	Model 2 (1)	1			1		
		(ii)	Any four x (1) from <ul style="list-style-type: none"> • model 1 has 4 species, model 2 has 2 • model 1 shows gradual change in morphology • model 2 shows sudden change in morphology/model 2 shows morphology remaining the same for long periods of time (stasis) • model 1 shows ancestral extinction of prior species/model 2 shows ancestral species survives • in model 1, species B evolves into 2 separate species/model 2 species E evolves into just 1 new species 	4			4		
			Question 1 total	10	3	2	15	6	6

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
2.	(a)		<p>Any three x (1) from:</p> <ul style="list-style-type: none"> • crystalline • coarse $\geq 3\text{mm}$ • contains olivine • contains augite 		3		3		3
	(b)	(i)	<p>3.4 (g cm⁻³) (1)</p> <p>% uncertainty in mass = $0.1/34 \times 100 = 0.3\%$ OR % uncertainty in volume = $0.5/10 \times 100 = 5\%$ (1)</p> <p>% uncertainty in density = $0.3 + 5 = 5.3\%$ (1) e.c.f.</p> <p>Alternatively, credit use of half the resolution i.e., 0.05/34 and 0.25/10 % uncertainty in mass = $0.05/34 \times 100 = 0.15\%$ OR % uncertainty in volume = $0.25/10 \times 100 = 2.5\%$ (1)</p> <p>% uncertainty in density = $0.15 + 2.5 = 2.65\%$ (1)</p>		3		3	3	3
		(ii)	<p>Any two x (1) from:</p> <ul style="list-style-type: none"> • take repeats • calculate a mean • identify and remove anomalous results • use a more precise/higher resolution instrument to measure volume/mass 			2	2		2

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
	(c)	(i)	Any two x (1) from: <ul style="list-style-type: none"> • increases • from 3.3 to 4.2 g cm⁻³ or other quantification • stepped appearance • two stages, rapid then gradual density increase • decreases between ~100-150km/in the asthenosphere/ starts to decrease at 100km 	2			2	2	2
		(ii)	←P to match density in (b) (i)	1			1	1	1
		(iii)	Any two x (1) from: <ul style="list-style-type: none"> • xenolith • peridotite fragment incorporated into magma • credit reference to stopping Any two x (1) from: <ul style="list-style-type: none"> • less dense magma rises upwards • lava with xenolith erupts at surface • basalt with xenolith cools/solidifies at surface • reference to mantle plume/hotspot <p>to a maximum of 3 marks</p>	3			3		
	(d)	(i)	Core is denser than global mean/mantle/5.5g cm ⁻³ (1)		1		1		
		(ii)	Reference to iron composition (1) Reference to (outer) core mobile/liquid/convection currents (1)	2			2		
			Question 2 total	8	7	2	17	6	11

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
3.	(a)		550-600 °C (1) 1.15-1.20 GPa (1)	2			2	2	2
	(b)		<p>Indicative content</p> <p>Maximum temperature and pressure each rock suffered pathway 1 temperature ~ 620 °C pressure ~ 0.17 GPa pathway 2 temperature ~ 860 °C pressure ~ 1.21 GPa</p> <p>Relative timing of the temperature and pressure maxima Duration of pathway 1 ~18Ma and duration of pathway 2 ~36Ma</p> <p>pathway 1 maximum temperature reached before maximum pressure first maximum temperature between 12-18 Ma then maximum pressure between 6-12 Ma</p> <p>pathway 2 maximum pressure reached before maximum temperature first maximum pressure between 30-36 Ma then maximum temperature between 18-24 Ma</p> <p>Sequence of mineral stability fields each rock passed through pathway 1 only andalusite stability field pathway 2 kyanite then sillimanite then andalusite stability fields</p>		6		6	6	6

Question		Marking details	Marks Available					
			AO1	AO2	AO3	Total	Maths	Prac
		<p>Type and grade of metamorphism each rock underwent pathway 1 contact/thermal metamorphism low/medium/low grade pathway 2 regional metamorphism medium/high/medium/low grade</p> <p>5–6 marks There is a clear response which describes all four of the prescribed aspects of both metamorphic pathways. All the evidence is interpreted competently. The difference in the type and grade of metamorphism is fully appreciated as is the differing stability fields through which the rocks have passed. The difference in the sequencing between temperature and pressure maxima in the two pathways is appreciated. Exemplar values are fully quoted. <i>There is a sustained line of reasoning which is coherent, substantiated and logically structured. The information included in the response is relevant.</i></p> <p>3–4 marks The response describes at least three of the prescribed aspects of both metamorphic pathways. Most of the evidence is interpreted coherently. Relationships may only be partially developed. Exemplar values are partially quoted. <i>There is a line of reasoning which is partially coherent, supported by some evidence and with some structure. Mainly relevant information is included but there may be some irrelevant information or minor errors.</i></p>						

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
			<p>1–2 marks The response describes just one or two of the prescribed aspects. The evidence is discussed with only rather superficial comment and there is a lack of relevance in places. <i>There is a basic line of reasoning which is not coherent, supported by limited evidence and with very little structure. There may be significant errors or the inclusion of much irrelevant information. Max 1 if only 1 pathway considered.</i></p> <p>0 marks No attempt made or no response worthy of credit</p>						
	(c)	(i)	<p>Any four x (1) from:</p> <ul style="list-style-type: none"> contains kyanite so must have passed through kyanite stability field contains sillimanite so must have passed through sillimanite stability field contains garnet suggests medium grade regional metamorphism foliated/schistosity/alignment of crystals/kyanite indicates high/directed pressures/regional metamorphism complete recrystallisation/coarse crystals/sillimanite indicate high temperatures <p>3 max. for using kyanite and sillimanite only</p>			4	4		
		(ii)	<p>Any three x (1) from:</p> <ul style="list-style-type: none"> not enough time not high enough temperature insufficient heat energy to enable recrystallisation of kyanite/sillimanite to andalusite 		3		3		
			Question 3 total	2	9	4	15	8	8

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
4.	(a)		<p>Any three x (1) from:</p> <ul style="list-style-type: none"> regularly spaced - false named examples related to spacing some are at plate boundaries - e.g., Iceland some not at plate boundaries - e.g., Yellowstone 			3	3		
	(b)		<p>Any three x (1) from:</p> <ul style="list-style-type: none"> higher velocity p-waves directly below Yellowstone implies colder rock beneath Yellowstone no hot plume in mantle mantle beneath Yellowstone has average temperature anomalously hot rocks/low velocity P waves predominantly in upper mantle towards X 		3		3		
	(c)	(i)	<p>Divergent boundary, between 5-40km where the geotherm crosses the onset of melting line and hot spot, between 85km and 115km where geotherm crosses the onset of melting line (1)</p> <p>Where geotherm crosses the onset of melting line (1)</p> <p>Temperature is higher than the melting point of the rocks/this is where the melting begins (1)</p>		3		3		1
		(ii)	<p>Any three x (1) from:</p> <ul style="list-style-type: none"> extension/tension/diverging/pulling apart thinning of lithosphere/base of lithosphere rises/asthenosphere rises increase in geothermal gradient/geotherm shifts upwards decompression 		4		4		

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
			<p>Any three x (1) from:</p> <ul style="list-style-type: none"> • mantle plume • elevated temperatures/ (in the topmost part of the asthenosphere/below the lithosphere) or relevant temps quoted from the diagram e.g., 1700 °C v 1500 °C • geotherm shifts to right • element of decompression/lithosphere rising <p>To a total of 4 marks</p>						
		(iii)	<p>Any two x (1) from:</p> <ul style="list-style-type: none"> • mafic/basaltic lava • source is partial melting of mantle/peridotite/ultramafic • limited contamination/fractional crystallisation 		2		2		
			Question 4 total	0	12	3	15	0	1

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
5.	(a)	(i)	Bar with a frequency of 7 for 0° - 10° (1) Bar with a frequency of 4 for 30° - 40° (1)	2			2	2	2
		(ii)	Any three x (1) from: <ul style="list-style-type: none"> deposits contain iron minerals when deposited alignment with prevailing magnetic field remanent magnetism/palaeomagnetism preserved inclination of magnetic field determined Credit reference to use of basalts	3			3		
		(iii)	Recent/Quaternary ice sheets/glacial deposits found in polar regions/specified latitudes e.g., to 45° N (1) Neoproterozoic ice sheets/glacial deposits were found at lower latitudes/specified latitudes/closer to the equator (1)	2			2		

Question		Marking details	Marks Available					
			AO1	AO2	AO3	Total	Maths	Prac
	(b)	<p>Indicative content</p> <p>Figure 5a Neoproterozoic glacial deposits found on nearly all continents but not in Antarctica (may be covered by ice) and not in oceanic settings (too young) and continents may not have covered all longitudes Many locations have no data on palaeolatitude so it may be possible that the Neoproterozoic glacial deposits did form at higher latitudes</p> <p>Figure 5b Neoproterozoic glacial deposits formed at latitudes between 0° and 60° but no evidence at higher latitudes</p> <p>Figure 5c Neoproterozoic deposits are both texturally and mineralogically immature concordant with being dumped by a glacial / tillite / ancient boulder clay although grain rounding may be indicative of deposition by water</p>			6	6		

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
			<p>5–6 marks There is a clear response which describes the evidence from all three Figures. All the evidence is interpreted competently. A thorough evaluation of the data in at least two of the Figures is provided. <i>There is a sustained line of reasoning which is coherent, substantiated and logically structured. The information included in the response is relevant.</i></p> <p>3–4 marks The response describes evidence from at least two of the Figures. Most of the evidence is interpreted coherently. A partial evaluation of the data in at least one of the Figures is provided. <i>There is a line of reasoning which is partially coherent, supported by some evidence and with some structure. Mainly relevant information is included but there may be some irrelevant information or minor errors.</i></p> <p>1–2 marks The response describes evidence from just one or two of the Figures. The evidence is discussed with only rather superficial comment and there is a lack of an evaluation. <i>There is a basic line of reasoning which is not coherent, supported by limited evidence and with very little structure. There may be significant errors or the inclusion of much irrelevant information.</i></p> <p>0 marks No attempt made or no response worthy of credit</p>						
			Question 5 total	7	0	6	13	2	2

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
6.	(a)	(i)	Peak oil formation = 95-105 °C (1) Peak gas formation = 145-155 °C (1)	2			2	2	2
		(ii)	0.035-0.038 °C m ⁻¹ (1) Answer in the correct range to 2 s.f (1)		2		2	2	2
		(iii)	Depth of peak oil formation would be shallower (1) Higher temperature/energy enable cracking/breaking bonds of HCs to occur at shallower depths (1)			2	2		
	(b)	(i)	Base of oil-bearing section 20m below top of the sandstone sequence (1)		1		1		1
		(ii)	Any three x (1) from: <ul style="list-style-type: none"> • sandstones are reservoir rocks • sandstones are porous and permeable • shale acts as a cap rock • shale is impermeable • shale is a source rock • upward migration of oil 		3		3		
	(c)	(i)	Position of both lines in correct location (1) Three zones correctly named (1)		2		2		

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
		(ii)	<p>Any three x (1) from:</p> <ul style="list-style-type: none"> • microfossils more common in the sequence/only two occurrences of ammonite • microfossils found in different rock types/ammonites only found in shales • microfossils found in marine and non-marine rocks/ ammonites only found in marine rocks • ammonites offer greater resolution/precision/accuracy • ammonites evolved more rapidly/existed in shorter time zones 			3	3		
			Question 6 total	2	8	5	15	4	5
			Paper Totals	29	39	22	90	26	33